



## TO STUDY THE AGE OF FUSION OF FIRST COSTAL CARTILAGE WITH MANUBRIUM IN NORTH INDIAN POPULATION.

### Anatomy

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### ABSTRACT

**Objective-** To study the age of fusion in sternal end of the costal cartilage of the first rib with manubrium as seen with naked eyes.

**Methods-** The present study has been conducted in the Department of Anatomy in collaboration with the Department of Forensic Medicine, Pt. B.D. Sharma PGIMS, Rohtak. For the study, the specimen comprised of 50 pairs of first rib along with manubrium in both sexes in the age ranging from 15-30 years, collected from the cases of medico-legal autopsies done in Department of Forensic Medicine after taking proper consent from the legal heir of the deceased and were then cleaned and observed with naked eyes.

**Results-** To study the age of fusion of first costal cartilage with manubrium, the specimen were observed with naked eyes and were classified in the following categories- non fusion, beginning of fusion, active fusion, complete fusion. The mean age of non-fusion was 17.1 years in females and 16.2 years in males. The mean age of active fusion was 22.1 years in males and 23 years in females. The mean age of complete fusion was 27.4 years in males and 27.6 years in females.

**Conclusion-** The fusion of first costal cartilage with manubrium proceeds faster in males as compared to females.

### KEYWORDS

Fusion, first rib, naked eye.

### INTRODUCTION

The first rib has a primary centre for the shaft that appears around 2nd month of intrauterine life. Secondary centres for the head and tubercle appears around puberty. Fusion is completed by 20 years<sup>1</sup>. The first chondrosternal joint is an unusual variety of synarthrosis inaccurately called as synchondrosis. The attachment of the first rib to sternum also becomes a synostosis with age<sup>2</sup>. Naked eye appearance of first costal cartilage and its appearance radiographically seem to be a less addressed area. Since there is dearth of literature about the naked eye appearance and radiographic appearance of first costal cartilage calcification in North Indian Population, this present study is conducted subsequently. Age estimation in cadavers, human remains and living individuals is important because it clarifies issues with significant legal and social ramifications.

### MATERIAL AND METHOD

The present study was done in the Department of Anatomy in collaboration with the Department of Forensic Medicine, Pt. B.D. Sharma PGIMS, Rohtak. Specimen comprised of 50 pairs of first rib along with manubrium in both sexes in the age ranging from 15-30 years. The specimen were collected from the cases of medico-legal autopsies done in Department of Forensic Medicine after taking proper consent from the legal heir of the deceased.

#### The following cases were excluded from the study:-

Accident/Trauma cases where first rib or manubrium had been fractured.

Cases in which first rib or manubrium was distorted during autopsy.

First rib or manubrium showing any fracture or malunion.

The bones were retrieved from the cadaver and were tagged and numbered. The bones were left in the glass container filled with saturated solution of sodium chloride for 6-8 weeks to macerate the soft tissue. They were cleaned and dried to see the fusion of sternal end of the costal cartilage of first rib with manubrium.

Scoring system used by McKern and Stewart<sup>3</sup> was utilized for grading into the following degrees:

(1) **Non fusion: No bony overgrowth over first costal cartilage (figure 1)**



Figure 1

(2) **Beginning of fusion: 25%- <50% bony overgrowth**

(3) **Active fusion: 50% -75% of the surface was covered by bony overgrowth (Figure 2)**



Figure 2

(4) **Complete fusion: when the entire surface was covered by bony overgrowth (Figure 3)**



Figure 3

### OBSERVATION AND RESULTS:

**Table 1: Minimum, Maximum and Mean age of non-fusion in Males and Females**

Number of cases	Minimum (age in years)		Maximum (age in years)		Mean $\pm$ S.D.# (age in years)		p value*
	Right	Left	Right	Left	Right	Left	
Males (24)	15	15	19	19	16.2 $\pm$ 1.22	16.2 $\pm$ 1.22	0.11
Females (6)	16	16	19	19	17.1 $\pm$ 1.17	17.1 $\pm$ 1.17	

**Table 2: Minimum, maximum and mean age of active fusion in both sexes.**

Number of cases	Minim um	(age in years)	Maxi mum	(age in years)	Mean $\pm$ S. D.#	(age in years)	p value
	Right	Left	Right	Left	Right	Left	0.25
Males (6)	20	20	24	24	22.1 $\pm$ 1.47	22.1 $\pm$ 1.47	
Females (2)	22	22	24	24	23 $\pm$ 1.41	23 $\pm$ 1.41	

**Table 3: Minimum, maximum and mean age of complete fusion in both sexes.**

Number of cases	Mini mum		(age in years)		Maxim um		(age in years)		Mean $\pm$ S. D.#		(age in years)		p value*
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	
Males (9)	25	25	30	30	27.4 $\pm$ 2.40	27.4 $\pm$ 2.40							0.12
Females (3)	25	25	29	29	27.6 $\pm$ 2.31	27.6 $\pm$ 2.40							

#S. D. = Standard Deviation. \*p value < 0.05 is significant, p value > 0.05 is considered insignificant.

## DISCUSSION

According to Faruqui<sup>4</sup> age of non fusion in both sexes was less than 20 years. McKern and Stewart<sup>3</sup> reported that the union started at age 18, possibly as early as 17, and the majority fused by age 25.

Rist et al<sup>5</sup>, reported that ossification began in the male at seventeen years of age and in the female at nineteen years of age. From their study they concluded that the first cartilage was ossified in almost all individuals by the age of thirty-five years in the male and forty- five years in the females. Nishino<sup>6</sup> reported that the ossification of the first rib cartilage was seen earliest at the age of 16 years, and it was reported nearly in all the age groups of 30 and above and that ossification was more intensive in the first rib as compared to other ribs. The present study revealed that the mean age of active fusion was  $22.1 \pm 1.47$  years in males and  $23 \pm 1.41$  in females. The mean age of complete fusion was  $27.4 \pm 2.40$  in males and  $27.6 \pm 2.31$  in females. These findings are different from those reported by Rist et al<sup>5</sup> and Nishino<sup>6</sup>. This variation may be due to small sample size of the present study.

## CONCLUSION:

The present study concludes that fusion of first costal cartilage with manubrium proceeds faster in males as compared to females. It can also be concluded that males have more tendency for fusion of first costal cartilage with manubrium as compared to females in all the age groups taken for study. The possible reason for this could be as men are more usually exposed to labor respiratory stress as compared to females. The predictability to age of first costal cartilage fusion may serve as an important tool for Anatomists, Forensic experts in medicolegal cases, Anthropologists and Orthopedicians.

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